Utility Criteria Manual
SECTION 1 – WATER, REUSE WATER AND WASTEWATER
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1.1.0. GENERAL

The following information is intended to assist engineers and the general public in the design and construction of water, reuse water and wastewater facilities. Information herein is to provide minimum standards for the City of Round Rock (City) requirements only. Sound engineering judgment shall be provided to determine if these minimum requirements must be exceeded for a particular engineering design. All water, reuse water and wastewater design and construction must comply with the requirements of the State of Texas, when there is a conflict between State requirements and those contained herein, the more restrictive shall govern.

1.2.0. SERVICE EXTENSION PROCEDURE

1.2.1. General Information

This section is intended to provide information needed to obtain water, reuse water and wastewater service extension approval.

The service extension is not to be interpreted as a vehicle solely for the purpose of securing a utility commitment, but rather a procurement of rights to install utility mains, associated facilities and off-site improvements within the City's Water and Wastewater Service Area. The Water and Wastewater Service Area is the Impact Fee Boundary for the Water and Wastewater Utility of the City. It is a set of geographic boundaries within which water or wastewater service may be provided. Properties must be completely within the service area before service extension can be approved. These water and wastewater facilities are not extended through capital improvement programs or other City initiated projects.

A legal lot is an entire lot as shown in a recorded plat; a legal tract is a parcel of land, created by warranty deed prior to being subject to the platting regulations of the City that has remained in the same configuration. Utility service cannot be provided without a land status determination.

1.2.2. Service Extension Guidelines for Processing

A. All properties not within the full-purpose city limits of Round Rock must petition the City Council for service.

B. All extension requests within the full-purpose city limits not requiring City cost participation the City Engineer or Utility Director without any further action may approve reimbursement.

C. All service extensions requesting City cost participation or reimbursement must be submitted to the Utility Director for consideration and must be approved by the Round Rock City Council. (Anywhere in this document where it states Utility Director Approval, also means any person so authorized to approve on the Utility Director's behalf.)

D. Approved service extensions are not a reservation of capacity in the system, but are an acknowledgment of the intent to serve.

1.2.3. System Capacity Determination Procedure for Reviewing Service Extensions by the Water and Wastewater Utility

A. The Water and Wastewater Utility Department (W/WWUD) will determine existing facilities that are in place and any remaining capacity after considering all existing services connected to the system.

B. The W/WWUD will determine if additional system improvements are needed.

C. A service extension may or may not be approved depending on the time frame of approval, funding and construction of additional system improvements and related agreements and conditions.

1.3.0. PRIVATE PLUMBING

1.3.1. Plumbing Inspections Outside the City's Zoning Jurisdiction

Within the city limits of Round Rock and within the boundaries of the City's Extraterritorial Jurisdiction (ETJ) as specified by contract (outside-city installations), private plumbing installations shall be inspected by the Building Inspection Division to insure compliance with the International Plumbing Requirements, dated 2006 or as amended. New private plumbing installations on properties located outside of the zoning jurisdiction of the City for which the City provides direct retail water or wastewater service (outside-city installations), shall be inspected by the Building Inspection Division.

Plumbing installations shall not commence until a permit has been obtained from the Building Inspections Division and any applicable fee has been paid. For subsequent material improvements, corrections, or additions, a permit must be obtained before work begins. A valid permit must be posted at the site of every outside-city installation with each address posted and visible from two hundred (200) feet.

The inspector must complete a plumbing inspection, certifying that the plumbing installation is in compliance with the International Plumbing Code before final connection to the City water and/or wastewater systems may be made.

1.3.2. Adherence to State Rules and Regulations Relating to Backflow and Cross Connection Control

Backflow prevention assemblies that are installed in private plumbing systems, fire protection systems, process water systems, and/or other private water distribution systems that are directly or indirectly connected to the City's potable water distribution system shall be installed in accordance with the American Water Works Association (AWWA) standards. It shall be the responsibility of the property owner or the

representative of the property owner to provide verification of the required approvals upon request.

1.3.3. Backflow Installation Standards

Water customers directly connected to the City's potable water or reuse water distribution systems, when required, will install backflow prevention assemblies to the following minimum standards.

A. Atmospheric vacuum breakers and hose bib vacuum breakers will be installed to each of the following requirements:

1. Atmospheric vacuum breakers and hose bib vacuum breakers shall be installed in the vertical upright position unless otherwise listed.
2. Atmospheric vacuum breakers and hose bib vacuum breakers shall be installed a minimum of six (6) inches above all downstream piping and the highest point of discharge.
3. Atmospheric vacuum breakers and hose bib vacuum breakers installations or applications will not be subjected to back-pressure.
4. Shutoff valves will not be installed downstream of the device.
5. Atmospheric vacuum breakers and hose bib vacuum breakers shall be installed as a unit and shall not be modified.
6. Installations will not be in an area where corrosive fumes or gasses could possibly render the device inoperative, corroded, or deteriorate the exterior of the assembly (fume hoods, car washes, chemical storage rooms, etc.).
7. Protection from freezing will be provided if installed in areas subjected to freezing temperatures or conditions.
8. Atmospheric vacuum breakers and hose bib vacuum breakers will not be subjected to continuous pressure for more than twelve (12) hours out of a twenty-four (24) hour period.
9. Hose bib vacuum breakers will be a non-removable type.

B. Double check valve assemblies may be utilized on premises where a substance is handled that would be objectionable but not hazardous to health, if introduced into the potable water system. Double check valve assemblies will be installed as a unit, and will not be disassembled to allow fittings, strainers, or the installation of other devices between the shutoff valves. Double check valve assemblies will be installed to the following requirements:

1. Above Grade or Floor Installations
    a. Double check valve assemblies will be in the horizontal upright position unless otherwise approved by the City Engineer.
    b. Double check valve assemblies will not be rotated on their axis, unless otherwise approved by the City Engineer.

c. Assemblies installed over five (5) feet above finished floor or grade will have a platform for maintenance, testing and repair. Platform designs shall be designed to sound engineering practices and the design sealed by a registered Professional Engineer.

d. A twenty-four (24) inch clearance will be maintained on the service side of the assembly to permit access for testing, service, repairs, and replacement.

e. Installations will be twelve (12) inches above finished grade or finished floor.

f. A minimum of twenty-four (24) inches unobstructed access will be provided on the service side of the assembly.

g. Threaded assemblies will be installed with a minimum six (6) inch clearance from its outermost dimension to a wall or other obstruction.

h. Flanged assemblies will be installed with a minimum of twelve (12) inches clearance from its outermost dimension to a wall or other obstruction on the non-service side of the assembly.

i. Protection from freezing will be provided if installed in areas subjected to freezing temperatures or conditions.

2. Below Grade Installations

a. Double check valve assemblies will be in the horizontal upright position unless otherwise approved by the City Engineer.

b. Double check valve assemblies will not be rotated on their axis, unless otherwise approved by the City Engineer.

c. Test cocks will be plugged or capped.

d. Test cocks will discharge vertically upward.

Note: Fittings may be installed in the test cocks to redirect the discharge vertically upward.

e. A twenty-four (24) inch clearance will be maintained on the service side of the assembly to permit access for testing, service repairs and replacement.

f. Flanged double check valve assemblies installed in vaults will have a minimum of twelve (12) inches clearance to a wall or other obstruction on the non-service side of the assembly.

g. Flanged double check valve assemblies installed in vaults will maintain twelve (12) inches minimum clearance from the lowermost point of the backflow prevention assembly to the vault flooring.

h. Flanged double check valve assemblies installed in vaults will maintain a minimum of six (6) inches clearance from the uppermost portion of the assembly to the underside of a vault lid, with the shutoff valves in the open position.

i. Vault access openings for flanged assemblies will not be less than thirty (30) inches in the least dimension.

j. Threaded assemblies installed in vaults less than eighteen (18) inches deep will have a minimum of four (4) inches clearance from the shutoff valves to the inside walls of the vault.

1) A minimum of four (4) inches clearance will be maintained from the uppermost part of the threaded double check valve assembly to the underside of the vault box lid.

2) A minimum of three (3) inches clearance from the lower most point of the backflow prevention assembly to the flooring in the vault.

3) Vault access openings will not be less than sixteen (16) inches long and ten and three-fourths (10 ¾) inches wide.

4) Installations deeper than eighteen (18) inches below finished grade will be installed in accordance with the requirements of this section for flanged double check valve assemblies.

Note: The opening on either vault will be large enough to permit access for testing, repair and replacement of the assembly.

C. The reduced pressure backflow assembly will be installed as a single unit. Reduced pressure backflow assemblies will not be disassembled to allow fittings, strainers or the installation of other devices between the shutoff valves. Reduced pressure backflow assemblies will comply with the following requirements:

1. Installations will be in the horizontal upright position unless otherwise listed by the City Engineer.
2. Rotation on their axis is not permitted, unless otherwise approved by the City Engineer.
3. A twenty-four (24) inch clearance will be maintained on the service side of the assembly to permit access for testing, service repairs and replacement.
4. Installations will be twelve (12) inches above finished grade or finished floor.
5. Installations will be with a minimum twenty-four (24) inches clear access on the service side of the assembly.
6. Twelve (12) inches minimum clearance will be maintained above the assembly.
7. Above ceiling installations are not permitted.
8. Assemblies installed over five (5) feet above finished floor or grade will have a platform for maintenance, testing and repair. Platform designs shall be designed to sound engineering practices and the design sealed by a registered Professional Engineer.
9. Installations are not permitted in an area where corrosive fumes or gasses could render the assembly inoperative, corroded or deteriorate the exterior of the assembly (i.e. fume hoods, car washes, chemical storage rooms, etc.).
10. Installations in a pit or below finished grade are not permitted.

11. Protection from freezing will be provided if installed in areas subjected to freezing temperatures or conditions.
12. Threaded reduced pressure backflow assemblies will be installed with a minimum six (6) inches clearance from its outermost dimension to a wall or other obstruction on the non-service side of the assembly.
13. Flanged reduced pressure backflow assemblies will be installed with a minimum of twelve (12) inches clearance from its outermost dimension to a wall or other obstruction on the non-service side of the assembly.

D. Each pressure vacuum breaker assembly may be installed at point-of-use protection only and where a substance is handled that would be objectionable but not hazardous to health, if introduced into the potable water system. Pressure vacuum breakers protect against back-siphonage only and shall not be installed where there is potential for back-pressure contamination. Pressure vacuum assemblies will be installed as an assembly, and will not be modified to allow fittings, strainers, or other devices to be installed between the shutoff valves. Pressure vacuum breaker installations will comply with the following requirements:

1. Installation will be in the vertical upright position unless otherwise approved by the City Engineer.
2. Installations will be not less than twelve (12) inches above all downstream piping and the highest point of discharge.
3. Installations or applications will not be subjected to backpressure.
4. Shutoff valves may be installed downstream of the assembly.
5. Installations above ceilings are not permitted.
6. Assemblies installed over five (5) feet above finished floor or grade will have a platform for maintenance, testing and repair. Platform designs shall be designed to sound engineering practices and the design sealed by a registered Professional Engineer. Each assembly shall have a minimum clearance of twelve (12) inches in all areas immediately adjacent to the assembly.
7. Installations where structural damage may occur are not permitted.
8. Installations are not permitted in areas where corrosive fumes or gasses could render the assembly inoperative, corrode or deteriorate the exterior of the assembly, (i.e., fume hoods, car washes, chemical storage rooms, etc.).
9. Protection from freezing will be provided if installed in areas subjected to freezing temperatures or conditions.
10. Installations shall not be installed in any area subject to flooding of where damage may occur from water discharge.

E. A spill resistant vacuum breaker assembly will be installed as a unit. Spill resistant pressure vacuum breaker assemblies will not be modified to allow

fittings, strainers, or other devices to be installed between the shutoff valves. Pressure vacuum breaker installations will comply with the following requirements:

1. Installation will be in the vertical upright position unless approved by the City Engineer.
2. Installations will be not less than twelve (12) inches above all downstream piping and the highest point of discharge.
3. Assemblies installed over five (5) feet above finished floor or grade will have a platform for maintenance, testing and repair. Platform designs shall be designed to sound engineering practices and the design sealed by a registered Professional Engineer.
4. Installations or applications will not be subjected to backpressure.
5. Shutoff valves may be installed downstream of the assembly.
6. Installations above ceilings are not permitted.
7. Installations where structural damage may occur are not permitted.
8. Installations are not permitted in areas where corrosive fumes or gasses could render the assembly inoperative, corroded deteriorate the exterior of the assembly, (e.g. Fume hoods, car washes, chemical storage rooms, etc.).
9. Protection from freezing will be provided if installed in areas subjected to freezing temperatures or conditions.

1.3.4. Cross Connection Inspections Will Be Conducted Upon Installation of Reuse Water Service and Annually Thereafter, Using One of the Following Methods:

A. Method #1:

1. Isolating each of the water customer's potable water services, including fire protection services, and draining the pressure to determine if an interconnection has been made.
2. The customer's potable water service will be isolated at the service connection or water meter.
3. Property owner's shutoff will be positively closed or replaced with a City W/WWUD approved shutoff valve.
4. Water pressure will be relieved from the customer's potable water distribution system.
5. The reuse water system will remain charged at full pressure with the appropriate meter open, with a start test meter reading noted.
   a. The customer's potable water distribution system (plumbing system) will be

drained to atmosphere.

Note: Services extending from potable water meters equal to or less than one and one half (1 ½) inch in size will remain open to atmosphere for a minimum of ten (10) minutes. Services extending from potable water meters equal to or greater than two (2) inches in size will remain open to atmosphere for a minimum twenty (20) minutes.

b. The reuse water meter will be read for water consumption.

B. Alternate inspection methods may be submitted to the City Engineer and Utility Director for approval.

C. A registered Professional Engineer may witness, attaches his/her seal to the inspection report, and files a report with the City Engineer. This report will certify separation of the potable and reuse water or auxiliary (private well) water systems through tests using sound engineering practices thereby verifying that a cross connection with the City's potable water system does not exist.

D. If a cross connection is noted or identified during the inspection, then potable water service will be terminated by the W/WWUD until such time that the cross connection has been permanently eliminated. The water customer may reapply for service at this time.

Note: In each of the cross connection inspection methods identified above, the presence of a double check valve assembly is required to be verified at the service connection to the City's reuse water system and auxiliary water system.

E. The cross connection inspection/survey may be completed by utility personnel or persons with the following credentials:

1. Plumbing Inspectors
2. Professional Engineer registered with the State of Texas.

1.4.0. CONSTRUCTION PLAN INFORMATION AND SUBMITTAL REQUIREMENTS

1.4.1. General Information

A. Construction plans for water, reuse water and/or wastewater installation associated with development shall be submitted to the Development Services Office (DSO) for acceptance. Construction plans for other water and/or wastewater installations shall be submitted to either the DSO or the W/WWUD for acceptance. Plans shall be resubmitted for acceptance if construction does not commence within two (2) years from the date of acceptance. The resubmitted plans must include and comply with all design and construction criteria in effect at the time resubmitted.

B. If the provider of service is a Municipal Utility District (MUD), Water Control and Improvement District (WCID) or private utility corporation, then prior approval by

the provider of service are also required.

C. Plans submitted must show approved easements and/or permits on highway and/or railroad crossings.

D. A signature on the plans by the City Engineer, the Utility Director, or their respective designee constitutes acceptance of the plans.

E. Plans associated with a site development must have approval from the City Fire Department and the DSO.

F. All water, reuse water and/or wastewater plans will include the following items:

1. Engineer's dated signature and seal of a Professional Engineer licensed in the State of Texas on each plan sheet.
2. Date of plans and revisions.
3. North arrow and scale shall be shown. The standard horizontal scale shall be 1" = 50', 40', 20', or 10’ (plan view) with respective vertical scale 1" = 5', 4' or 2', or 1’ (profiles). Scales used on each plan and profile sheet shall be the same. For sheets other than plan and profile, a horizontal scale of 1" = 50', 40', 20’, or 10' may be used as appropriate. The City Engineer or Utility Director may require a larger-scale be used for plan and profile sheets, or a large-scale blowup of a particular area.
4. A general location map.
5. Standard City Water and Wastewater construction notes can be found in the City’s Design and Construction Standards (DACS) - General Guidelines.
6. Indicate on cover sheet all required permit numbers such as development permit, Texas Department of Transportation (TxDOT) permit, railroad crossing permit, etc. The project name shall be along the top right hand border, reading from the bottom of the sheet to the top of the sheet.
7. Volume and page number of recorded easements and any temporary working space/easements.
8. Size, pipe material and location of main with respect to easements, rights-of way, and property lines.
9. Property lines and dimensions, legal description, lot and block numbers, right-of-way dimensions, curbs, sidewalks, pavements, power poles, trees, and other plan metric features, locations, and street names.
10. Location, vertical and horizontal, size and material of all existing water, reuse water and wastewater mains, lines and services. The direction of flow in the wastewater mains shall be indicated.
11. Location, vertical and horizontal, size and description of other utilities where they may conflict with water, reuse water or wastewater mains or other service lines shall be shown in both the plan and profile.
12. Curve data for roads, property lines, and water, reuse water and wastewater lines.

13. Final plat recording or land status report.
14. Street address for all existing structures shall be shown on the lot(s) where the structures are located.
15. Pressure zone designation for subject tract and zone boundaries where applicable.

G. The following items may be required prior to plan acceptance:

1. TxDOT permit;
2. Railroad permit;
3. Gas Company permit;
4. Easement acquisition, with volume and page or document number shown on plans;
5. County approval;
6. Water District approval;
7. MUD approval;
8. Texas Department of Health (TDH) approval;
9. Texas Commission on Environmental Quality (TCEQ) approval;
10. Non-occupancy letter;
11. Service Extension approval; and
12. DSO approvals.

1.4.2. Water and Reuse Water System Plans

A. All plan view drawings shall include all applicable items listed in Section 1.4.1.G. above plus the following:

1. Stations of all proposed connections to existing or proposed water mains.
2. For proposed connections to water and reuse water mains or facilities to be constructed by others, identify the project by name and the design engineer.
3. Station numbers for mains shall be identified for beginning points, ending points, points of curvature, points of tangency, points of reverse curve, points of intersection, valves, fire hydrants, other appurtenances and grade breaks.
4. Station numbers shall be identified for the water, and reuse water mains where they cross any other utility.
5. Details of appurtenances shall be shown.
6. The location of all existing and proposed water services, water mains, reuse water mains, valves and fire hydrants shall be identified.
7. Ultimate 100-year flood plain limits shall be shown.

8. Design velocity at maximum day plus fire flow and at peak hour.
9. Calculated design pressure at highest and lowest lot served shall be shown. These pressures shall be a minimum of thirty five (35) pounds per square inch (psi) at peak hour demand and a maximum of one hundred ten (110) psi static pressure.
10. Thrust restraint, when required, shall be noted on the plan.
11. Retaining walls, including geogrid, straps, tiebacks and all other components.
12. Culverts, bridges and other drainage structures.

B. A profile view shall be provided for all water mains twelve (12) inches in diameter and larger showing all applicable items listed in the Design and Construction Standards General Guidelines plus the following:

1. The existing ground profile, proposed finish grade, and subgrade, if under pavement.
2. Station numbers and elevations of all utility crossings.
3. Station numbers and soil geology information at stream crossings to evaluate the need for special surface restoration.
4. Identify pipe size, percent grade and pipe material to be used including American Society for Testing and Materials (ASTM) and/or AWWA designation. If an alternate material is to be allowed, both should be listed (example "D.I., Class 150 or PVC, Class 150"). Purple pipe or purple wrapping shall be identified for reuse water line.
5. Station numbers and elevations for starting points, ending points, point of intersection, grade breaks, valves, fire hydrants, air release valves, pressure/flow regulating valves and at intermediate points not exceeding fifty (50) feet.
6. Retaining walls, including geogrid, straps, tiebacks and all other components.
7. Culverts, bridges and other drainage structures.

1.4.3. Wastewater System Plans

A. All plan view drawings shall include all applicable items listed in Section 1.4.1.G. above plus the following items:

1. Station numbers at all proposed connections to existing or proposed wastewater mains.
2. For proposed connections to wastewater mains or facilities to be constructed by others, identify the project name and the design engineer.
3. The location, alignment and structural features of the wastewater main, including manholes and concrete retards, if applicable.
4. Station numbers for beginning points, ending points, manholes, clean-outs and

other appurtenances.

5. Details of all required appurtenances.
6. Location of all existing and proposed wastewater services, mains and manholes.
7. Ultimate 100-year flood plain limits.
8. Retaining walls, including geogrid, straps, tiebacks and all other components.
9. Culverts, bridges and other drainage structures.

B. A profile view shall be provided for all wastewater mains and shall include all applicable items listed in Section 1.4.1.G. above, plus the following:

1. The existing ground profile, proposed street finish grade and subgrade, or finished grade if not under pavement.
2. Station numbers and elevations of all utility crossings.
3. Station numbers and soil geology information at stream crossings to evaluate the need for special surface restoration.
4. Identify the pipe size, percent grade and pipe material to be used including ASTM and/or AWWA designation. If an alternate material is to be allowed, both should be listed (example "DI Class 150 or PVC DR 150").
5. Station numbers and elevations for starting points, ending points, manholes, clean-outs and at intermediate points not exceeding fifty (50) feet.
6. Elevations shall be indicated on the profile showing the finish floor elevations of all existing structures. If the structure has an active septic tank or other disposal system, the flow line elevation of the plumbing where it exits from the structure is to be indicated. If a lot or tract is vacant, side shots may be required from the middle of each lot to ensure gravity service is possible from the lot to the main.
7. Design flows, minimum and maximum, and flow velocities at minimum and maximum dry weather flows.
8. Retaining walls, including geogrid, straps, tiebacks and all other components.
9. Culverts, bridges and other drainage structures.

1.4.4 Reuse System Plans

A. All plan view drawings shall include all applicable items listed in Section 1.4.1.G. above plus the following:

1. Stations numbers at all proposed connections to existing or proposed reuse water mains.
2. For proposed connections to water mains or facilities to be constructed by others, identify the project by name and the design engineer.

3. Station number for mains shall be identified for beginning points, ending points, points of curvature, points of tangency, points of reverse curve, points of intersection, valves, other appurtenances and grade breaks.
4. Station numbers shall be identified for the reuse water mains where they cross any other utility.
5. Details of appurtenances shall be shown.
6. The location of all existing and proposed reuse water services, water services, reuse water mains, water mains, valves, and fire hydrants shall be identified.
7. Ultimate 100-year flood plain limits shall be shown.
8. Design capacities and velocities shall be shown.
9. Calculated pressure at highest and lowest possible service connections shall be shown. These pressures shall be a minimum of thirty five (35) pounds per square inch (psi) and a maximum of one hundred ten (110) psi static pressure.
10. Thrust restraint, when required, shall be noted on the plans.
11. Retaining walls, including geogrids, straps, tiebacks and all other components.
12. Culverts, bridges and other drainage structures.

B. A profile view shall be provided for all reuse water mains twelve (12”) inches in diameter or larger showing all applicable items listed in the Design and Construction Standards General Guidelines plus the following:

1. The existing ground profile, finish grade and subgrade, if under pavement.
2. Station numbers and elevations of all utility crossings.
3. Station numbers and soil geology information at stream crossings to evaluate the need for special surface restoration.
4. Identify pipe size, percent grade and pipe material to be used including American Society for Testing and Materials (ASTM) and/or AWWA designation. If an alternate material is to be allowed, both should be listed.
5. Station numbers and elevations for starting points, ending points, points of intersection, grade breaks, valves, fire hydrants, air release valves, pressure/flow regulating valves and intermediate points not exceeding fifty (50’) feet.
6. Retaining walls, including geogrids, straps, tiebacks and all other components.
7. Culverts, bridges and other drainage structures.
8. Identify “purple pipe” for PVC piping or “purple wrapped” for DI and Steel piping.

1.5.0. CONSTRUCTION INSPECTION AND CITY ACCEPTANCE

1.5.1. Construction Inspection Procedure

A City construction inspector will be assigned to each project. Prior to assignment, the following items must be submitted:

A. Prior to commencement of any construction, the developer or their design engineer shall convene a Pre-Construction Conference between the City, himself, the Contractor, other utility companies, any affected parties and any other entity the City may require. To set up a Pre-Construction Conference, the developer or their design engineer should contact the DSO or the W/WWUD, whichever is appropriate.

B. The required number of the signed plans and contracts must be submitted to the DSO or the W/WWUD whichever is appropriate at least three (3) working days before the Pre-Construction Conference. Please include the name and phone number of the contact person for the developer or their representative listed above.

C. The contractor shall call the Texas One Call Center for information on existing buried utilities.

1.5.2. City Acceptance

To obtain final City acceptance of a project, final quantities and cost information, along with the consulting engineer's concurrence for acceptance form, must be submitted. By ordinance, all subdivision construction is subject to a construction inspection fee. Any outstanding fees, based on final cost figures, must be paid prior to final acceptance.

If landscaping and vegetation items are outstanding, a conditional acceptance letter may be issued with the posting of a performance bond or other approved fiscal. When all work is completed and all necessary information is provided, a final acceptance letter will be issued.

If the project includes a lift station, the lift station will be considered separately for operation and maintenance acceptance (Refer to Section 1.6.3.).

1.6.0. LIFT STATION REVIEW, APPROVAL, AND ACCEPTANCE

1.6.1. Engineering Report, Plans, and Specifications Review and Acceptance

Acceptance of plans shall expire two (2) years from the date of acceptance. If construction has not begun on the facility within two (2) years of the acceptance date, plans must be resubmitted for acceptance and must include and comply with all design and construction criteria in effect at the time resubmitted.

The City does not encourage the use of lift stations within its wastewater collection system. In fact the City is actively working to eliminate existing lift stations where

possible and promotes the utilization of its gravity wastewater collection system by all new wastewater services. Also, the City does not necessarily consider depth and/or cost as a determining factor to require and/or approve connection to its gravity wastewater collection system via a lift station.

A. Prior to design, three (3) copies of a detailed engineering report shall be submitted to the W/WWUD or the DSO for review and approval of the lift station and all related line work. The engineering report shall include the following:

1. Justification for the proposed lift station. The report must clearly show that gravity lines are not available and are not economically feasible and that the number of lift stations has been minimized. This justification must include a cost benefit analysis of gravity versus lift station project including thirty (30) years of operation and maintenance of the proposed system.

2. A master development plan for the service area of the proposed lift station shall be prepared. This plan shall include a map showing the location of the lift station, the service area topographic information with two (2) feet contours, the boundaries of the drainage basin, and the location of the nearest existing wastewater interceptor within that basin.

3. Engineering calculations and data described in Sections 1.8.3.A. and 1.8.3.H. shall be contained in the engineering report.

4. The DSO and the W/WWUD prior to beginning preparation of the plans and specifications shall review and approve the Engineering Report.

5. TCEQ approval of the lift station is required prior to City approval.

B. All plans and specifications for lift stations within the City's ETJ, submitted for review and acceptance, must demonstrate compliance with current City Water and Wastewater Utility Design Criteria and standard lift station specifications. Acceptance of the lift station plans and specification does not imply the City W/WWUD will accept the lift station for operation and maintenance (Refer to 1.6.3.).

1. Within the Water and Wastewater Impact Fee Service Area as defined in Section 1.2.1 of this Manual, the following type of lift stations may be submitted for review and acceptance:

   a. Submersible or grinder pump facilities with rated horsepower no greater than twenty-five (25) Brake Horse Power (BHP) for the largest pump.

   b. For installation with a required rated horsepower motor greater than twenty-five (25) BHP the W/WWUD prefers wet/dry well type installation. However, submersible non-clog pump facilities with a rated horsepower of between twenty-five (25) BHP and fifty (50) BHP may be considered on a case-by-case basis. The Engineer must submit cost comparisons for submersible versus wet/dry well installations. The cost comparison should include initial station costs, pump replacement costs, installation costs and all operational and maintenance cost including energy costs over the life of the station. The

comparison should assume a typical service life for submersible pumps.

2. Within the City's ETJ but outside the Water and Wastewater Utility Impact Fee Service Area, submersible non-clog pump facilities with a rated horsepower of twenty-five (25) to fifty (50) BHP may be considered on a case-by-case basis.

1.6.2. Submittal and Shop Drawing Review

Once the engineering report, plans and specifications have been accepted, at least three (3) complete sets of submittals and construction plans shall be provided to the DSO or the W/WWUD. These submittals shall contain complete detailed information and drawings for all lift station equipment and components.

1.6.3. City Operation and Maintenance Acceptance

The City may accept a lift station with a firm pumping capacity greater than twenty-five (25) gallons per minute (gpm) for operation and maintenance provided the following conditions are met:

A. The station is located within the City's approved wastewater service area and impact fee area.

B. The W/WWUD has inspected the lift station and determined that it is constructed in conformance to the City and TECQ requirements. Any lift station not conforming to Utility standards shall be upgraded to Utility standards before the City will accept the lift station for operation and maintenance.

C. The owner or his representative has provided all information requested in Sections 1.6.1. and 1.6.2. above, including five (5) complete sets of all Operations and maintenance (O&M) Manuals for all equipment installed with the lift station, and has received W/WWUD acceptance. The O&M Manuals should describe the general operations of the equipment and provide information on the proper maintenance procedures to be performed on the equipment.

D. The owner has granted the City a wastewater easement for the lift station and access road. A copy of the recorded easement plat, legal description and any other legal documents granting the easement shall be delivered to the W/WWUD or the DSO. The easement shall extend to at least five (5) feet outside the lift station fence and shall include access road with turn-around areas that extend back to paved public right-of-way. This easement shall be separate and in addition to any necessary pipeline easement.

   If the lift station is to become a permanent installation, transfer of ownership and title to the land may be required by the Director of the W/WWUD or City Engineer prior to acceptance of the station for operation and maintenance.

E. A letter of assignment has been written to the City from the owner transferring title of the lift station and related equipment to the City. This letter shall be delivered to the W/WWUD or the DSO before acceptance of the lift station for

operation and maintenance. The original owner may regain title to a temporary lift station that was designed and constructed entirely at his expense and for which no refund was made by the City. After written notification by the City that the lift station has been abandoned, the original owner has one (1) month to notify the City in writing of his intent to regain title to the lift station.

F. One (1) complete set of reproducible mylar of the as-built drawings and a copy of the file on disk(s) in electronic format as specified by the W/WWUD and DSO shall also be provided to the City prior to acceptance of the lift station for operation and maintenance.

1.7.0. ABANDONMENT OF FACILITIES

If a new project will abandon existing facilities, the plans shall provide for the appropriate abandonment of these facilities.

1.7.1. Mains

Abandonment of wastewater mains in private easements shall consist of filling the main with a pumpable grout or slurry and meeting requirements of the current specifications. Plans should include method of abandoning all other mains.

1.7.2. Manholes

The abandoned manholes shall be removed to a level not less than two (2) feet below grade (the entire cone section should be removed). Inlets and outlets should be securely plugged, with grout for a minimum of 12” beyond outside wall of manhole and the structure filled with stabilized sand or granular material that is no greater than 1/2” maximum size. See standard detail for wastewater manhole abandonment.

1.7.3. Lift Stations

Abandonment of lift stations shall consist of removing all pumps, motors, couplings, valves, and controls from the dry well and all appurtenances above finished grade. Both the wet well and dry well shall be cut down four (4) feet below grade, filled with cement stabilized sand, and covered with top soil to grade. The associated force main shall be properly abandoned (see 1.7.1, above). This includes cutting and plugging both ends and/or grouting main as appropriate.

Area shall be re-vegetated. The W/WWUD shall be notified prior to abandonment.

1.7.4. Service Lines

All water service lines, including fire lines that are being abandoned and not transferred to a new distribution line shall be disconnected at the corporation stop or valve and removed. Valve or corporation stop shall be closed, plugged, and blocked with concrete thrust blocking. All other valves and appurtenances should be removed.

1.8.0. DESIGN REQUIREMENTS FOR WATER AND WASTEWATER SYSTEMS

1.8.1. Introduction

These guidelines are intended to establish the minimum basic design requirements for water and wastewater systems within the City and its ETJ, but do not address major facilities such as water and wastewater treatment plants. Generally, these systems will be operated and maintained by the City or under the Brushy Creek Regional Wastewater System. Some systems, such as certain municipal utility districts, will not be operated by the City immediately upon completion, but it is possible that the City will take over operation and maintenance at some time in the future.

All projects are required to be built in accordance with the City's DACS, which include other requirements not addressed here. All variations are subject to the approval of the City Engineer or the Utility Director. Additional requirements for specific projects may be established where the conditions of service to the tract and related system operation and maintenance needs warrant.

The following information is provided to assist engineers and the general public in the design and construction of water and wastewater facilities within the City's ETJ. All plans for such facilities shall be prepared by or under the supervision of a Professional Engineer, licensed in the State of Texas. It will be the responsibility of the engineer to ensure that the plans are in compliance with the latest versions of all applicable federal, state and local ordinances, rules and regulations.

These include, but are not limited to, the following:

A. Design Criteria for Sewage Systems - TCEQ.

B. Rules and Regulations for Public Water Systems - TCEQ.

C. Edwards Aquifer Rules - TCEQ

C. The Subdivision Ordinance and Utility Ordinances of the City.

D. City DACS - Standard Specifications Manual.

E. City DACS - Water and Wastewater Utility Design Criteria.

F. State of Texas Board of Professional Engineers

The design engineer shall prepare construction drawings in conformance with City requirements and accepted engineering practice, but also with consideration of future maintenance and operational concerns.

The following are specific criteria that the design engineer shall use in his/her design. Where conflict exists between State or Federal codes and City criteria, the more restrictive shall govern. The criteria below are intended as a guide for the design engineer and are not intended to be an exhaustive list. All items may not apply in all cases.

1.8.2. Water Systems

Priority is given to water facilities because of their critical nature. Pressure, supply, sanitation, and ease of maintenance of water facilities are paramount to all other public works concerns.

The developer shall provide all water lines necessary to properly serve each entire subdivision, addition or site development project, and insure that existing and/or new water facilities can supply the required demand, including fire protection. The developer shall install all necessary on-site and off-site mains and shall extend service to all lots terminating with a meter stop and meter box. For the orderly extension of water lines as established in the Water and Wastewater Master Plan, maintained by the City Utility Director, the developer shall install water mains to the boundaries of his development for future connection by the development of the abutting property. Extension of service lines to multi-family and non-residential lots in a multi-family or nonresidential subdivision or addition may be postponed until the development of the lots if a main is installed in the abutting right-of-way located on the same side of the street as the lot. The developer shall submit a letter certifying and sealed by a Professional Engineer licensed by the State of Texas that the system has been designed in accordance with the requirements of this section and conform to the rules, regulations, and requirements established by the TCEQ Design Criteria in the Texas Administrative Code, as amended.

Any water distribution system connecting to the City's water distribution system, whether public or private, shall be designed and constructed in accordance to the standards and specifications, herein.

A. Size/Capacity Determination

1. General

   a. Hazen Williams Friction Coefficient C = 120, higher C coefficient may be used for new mains only upon approval by the City with sufficient documentation to show effects of long-term use.

   b. Average day demand = two hundred and three (203) gal/person/day

   c. Peak day demand = four hundred and six (406) gal/person/day

   d. Peak hour demand = eight hundred and ninety-three (893) gal/person/day

   e. Maximum static pressure – one-hundred (100) psi unless otherwise approved by the Utility Director (fire hydrants will have attached a pressure-reducing valve (PRV) where pressure exceeds one-hundred ten (110) psi)

   f. If the maximum static pressure exceeds eighty (80) psi, a PRV will be required on the property owner's side of the water meter and should be shown on the plan view.

   g. Minimum operating pressure is fifty (50) psi at the highest elevation meter location using average day demand.

2. Peak Hour Demand Requirements

   a. The maximum allowable velocity shall not exceed five (5) feet per second

(fps).

b. The minimum pressure at any point in the affected pressure zone must not be less than thirty-five (35) psi.

3. Emergency Demand (Fire Flow) Requirements

The maximum allowable velocity shall not exceed ten (10) fps.

b. Fire flow (reference International Fire Code 2006, as amended) requirements will be determined in accordance with the City Fire Code and associated rules.

c. The minimum residual pressure at any point in the affected pressure zone at peak day plus fire flow must not be less than twenty (20) psi.

4. Sizing of Water Mains

All water mains shall be installed in accordance with the Water Master Plan maintained by the Utility Director. Computer modeling is preferred for sizing water mains. However, for water mains less than sixteen (16) inches in diameter other engineering calculation methods may be accepted. (However, no water main and/or fire main shall be sized smaller than that diameter shown in the City's Water Distribution System Master Plan or as determined utilizing the City's Water Distribution System Computer Model.) The largest size, as determined by comparing the service area's peak hour demand and peak day plus fire flow demand, shall be used. All water mains shall be sized to provide necessary service to the tract being developed. The City may require oversizing of certain mains in accordance with City ordinances.

5. Storage Requirements

If it is determined by W/WWUD that additional storage is required, the following criteria shall be used:

Effective Storage	=	100 gal/person
Emergency Storage	=	100 gal/person
TOTAL STORAGE	=	200 gal/person

Effective Storage is defined as storage that will provide a minimum of fifty (50) psi of pressure at the highest service elevation in pressure zone.

The Engineer may be required to provide computer simulations as determined on a case-by-case basis.

B. Mains

1. Minimum main size shall be eight (8") inches unless the Utility Director approves a smaller size because of unique circumstances. Provisions must be made for a flush valve at the end of dead end mains. Dead end mains are strongly discouraged by the City and must be approved by the City Engineer or Director of Utilities. Dead end mains containing over 100 gallons of water will require approved backflow prevention at the point furthest from the end of the dead end. The minimum size for any street type, however, will be governed by

various factors which include fire protection requirements, high density land usage, and the designer's consideration of general system gridding, future transmission mains, neighboring developments and area configuration. Looped systems are encouraged and required for service reliability. Transmission line sizes will be determined on a case-by-case basis if not already identified in the City's Water Distribution System Master Plan.

2. Ten (10") inch, fourteen (14") inch, and other non-standard pipe sizes will not be allowed in typical construction.

3. All water mains, including eight (8") inch, shall be profiled.

4. Water mains shall be located where maintenance can be accomplished with the least interference with traffic, structures, and utilities.

5. The separation between water and wastewater mains must comply with TCEQ rules or have a variance approved by the TCEQ before submittal to the City. Water mains shall be installed with a minimum of eighteen (18") inches clearance from other utility and drainage lines.

6. Standard assignment for water mains shall be nine (9') feet from the face of curb toward the right-of-way line and on the high side of the street according to natural topography unless otherwise accepted by the City Engineer. The latter requirement may be relaxed if it is demonstrated there is one or more compelling reasons to assign a main on the low side of a street (i.e. numerous crossings are avoidable, maintenance is facilitated, etc.)

   All mains shall be located within a public right-of-way, or within a recorded public utility easement or a City of Round Rock water line easement. Main assignments in City right-of-ways must be approved by the DSO. Mains in county right-of-ways must also be approved by the County Engineer.

7. Piping materials and appurtenances shall conform to the City's DACS - Standard Specifications Manual.

8. Minimum depth of cover over the pipe and all appurtenances shall comply with City's Standard Details; maximum depth will be as approved by the DSO and the Director of Utilities for the specific materials, application and conditions. Water mains shall be kept at reasonable depths of (three and one half feet to four feet (3 ½' to 4') cover in unpaved areas and a minimum of thirty (30) inches of cover below sub-grade in paved areas) and water main crossing under utilities shall be avoided. There will be some cases where mains at greater depths may be warranted, (i.e. larger mains, to accommodate vertical valves and where future locations of improvements are unknown, etc.). Water mains under wastewater mains are discouraged. Where unavoidable, water main crossings under other utilities or drainage pipes may be accepted by the City Engineer on a case-by-case basis. Such acceptance shall be based on detailed plans and exhibits that adequately explain and demonstrate the crossing. Encasement pipe shall be provided under permanent structures. Concrete encasement shall be avoided; concrete trench caps above bedding are generally acceptable.

9. For mains twelve (12”) inches and larger, drain valves shall be placed at low points, (i.e. fire hydrant or flush valves).

10. All fire lines shall have a gate valve on the line at the connection to the main line and a backflow preventer inside the property line, but accessible for inspection by City personnel. All un-metered fire lines shall have a Utility approved flow detection device.

11. The design engineer is responsible for determining when air/vacuum release valves are required and the size required. On water mains twelve (12”) inches in diameter and larger, automatic air release valves will be placed at all high points and at the down-slope side of all valve locations. Automatic air/vacuum release valves shall be approved on a case-by-case basis.

12. All pipe and accessories shall be of new materials only. Water mains shall be Ductile Iron (AWWA C-110, C-104 and ANSI/AWWA C-153/A21.53-84, min. pressure Class 150) or PVC (AWWA C-900/C-905, ASTM F477 and D3139, min. pressure Class 150) or HDPE (AWWA C-906, ASTM F714, NSF 61 and PE 3408 by ASTM 3350) with a minimum 13.5 dimension ratio (DR) for rehabilitation of existing water mains. Service piping shall be copper or polyethylene as accepted by the City Engineer. Minimum size of service lines shall be as follows:

Dwelling Units	Minimum Line Size
1	1”
2	1.5”
3-6	2”
7-11	4”
12-75	6”
More Than 75	8”

13. Double services shall be provided as often as possible to minimize the number of service lines to be maintained in the future and reduce time required for future meter reading. Service lines under pavement shall be placed, according to the most current City detail.

14. Water mains between residential lots, crossing blocks, shall be avoided. Water mains between residential lots may be allowed if the purpose is to prevent the creation of a Dead End Main and approved by the Director of Utilities. Water mains along the rear of residential lots, through back yards, shall be prohibited. Utility or easement lots may be appropriate in some cases.

15. Laying of water mains within state right-of-ways shall be prohibited unless such is warranted, as determined by the City Engineer and Director of Utilities. Water lines in easements abutting the state right-of-way are allowed, provided

easements are unobstructed and accessible.

16. Water mains in easements will be allowed, if it can be demonstrated that the easement will be unobstructed and accessible, and that the water main will be a minimum of fifteen (15') feet from any structure. Minimum easement width shall be fifteen (15') feet and an additional two (2') feet of easement width provided for every one (1) foot of depth of cover greater than seven (7') feet. Minimum easement between residential lots shall be thirty (30) feet.
17. **Meter boxes/vaults shall be reviewed and approved by the Utility Director.**
18. Under no circumstances shall more than thirty (30) Living Unit Equivalents (LUEs) be served by a single water main feed.
19. The City requires a looped water system with dead-end mains minimized. Dead-end mains must be approved by the City Engineer or the Director of Utilities.

C. Valves

1. There shall be a gate valve restrained to the main tee of each fire hydrant. These and all valves sixteen (16) inches and smaller, shall be resilient seated gate valves. In lines larger than sixteen (16) inches and smaller than thirty six (36) inches, double disc gate valves are specifically required, unless the Director of Utilities approves the use of butterfly valves at specific locations. In lines thirty six (36) inches and larger, butterfly valves may be used except in areas described below where double disc gate valves are specifically required.
2. Valves shall be located at the intersection of two (2) or more mains and shall be spaced so that no more than thirty (30") customers will be without water during a shutout. For lines smaller than twenty-four (24") inches, typical spacing should be five hundred (500) linear feet in high-density areas and twelve hundred (1,200) linear feet in a residential area, with a maximum spacing of one thousand five hundred (1,500) linear feet. Mains twenty four (24") inches to thirty (30") inches shall be valved at intervals not to exceed two thousand (2,000) linear feet. For lines thirty-six (36") inches and larger, valve spacing shall l not exceed two thousand five hundred (2,500) linear feet.
3. At dead end main that will be extended in the future, a gate valve shall be located one (1) pipe length back, with a twenty (20') foot minimum, from the end point (restrained plug) of the main. In lines larger than sixteen (16") inches, these shall be double disc gate valves. The Engineer shall provide and show drawings for complete restraint for all such valves, pipe extensions and end plug.
4. Branch piping, both new and future branches shall be separated from the main with gate valves. In branches larger than sixteen (16") inches these shall be double disc valves.
5. For mains twelve (12") inches and smaller, valves at street intersections shall be located at opposite point of curvature (p.c.) of the curb line.
6. All valves from six (6") inches to thirty (30") inches shall be gate valves. Gate

valves shall be located on each side of a tee or cross (i.e. each tee will require three (3) gate valves and each cross will require four (4) gate valves to be installed). Variations from these requirements require approval by the Director of Utilities.

7. Double disc gate valves may be required at locations where, in the judgment of the City Engineer or Utility Director, a complete shut out is critical.
8. The operating nut of any valve shall be between eighteen (18”) inches and thirty (30”) inches below finished grade. Extensions of valve nuts shall be provided as necessary to meet the depth requirement. Extensions shall not be fixed to operating nut.
9. Valves with valve extensions and those at pressure zone boundaries shall be equipped with a locking type debris cap.
10. All gate valves and butterfly valves shall be installed in accordance with the City’s Standard Details. The horizontal installation of gate valves is strictly prohibited.
11. Valves having "push on" joints are not permitted for fire hydrant leads and laterals.

D. Fire Hydrants

1. Fire hydrants shall be placed at a maximum of five hundred (500’) foot intervals along residential streets and a maximum of three hundred (300’) foot intervals along mercantile streets. Specific fire hydrant locations within a commercial, industrial, or multi-family site shall be coordinated with the City Fire Department. Consideration shall be given to accessibility and functionality of position when locating fire hydrants and such consideration could shorten the above stated spacing as required by the City Engineer or Utility Director. Fire hydrants shall be in conformance with AWWA specifications with National Standard Threaded (NST) outlets suitable for use with City fire protection equipment.
2. If required by the City Engineer or Utility Director, fire hydrants shall be installed on both sides of all divided road/highways. Roads/highways where opposing lanes of traffic are separated by a vertical obstruction shall be considered a divided road/highway.
3. For dead-end mains with no fire hydrant, an acceptable flushing device shall be required.
4. No private fire hydrants shall be allowed.
5. The entire fire hydrant assembly shall be restrained joints.
6. Fire hydrant assembly shall conform to the City’s Standard Details.

E. Services

1. Water services shall be constructed in accordance with the City’s Standard Details. More than two meters on a single service line will be considered on a

case-by-case basis.

2. Individual meter services will not be taken from transmission lines. Transmission lines are generally considered to be twenty-four (24") inches in diameter or larger. Exceptions must be approved by DSO and the W/WWUD at the time of plan submittal. The Professional Engineer shall submit a letter with this request.

F. Water Meters for Multi-Family and Commercial Customers

A master meter shall be required for all building permits issued by the City for all multi-family, manufactured home rental community, commercial property, or any other multiple-use facility, unless otherwise approved by the City in the original development process. The measurement of the quantity of water, if any, consumed by the occupants of each individual unit shall be provided by the following:

1. Sub-meters, owned by the property owner or manager, for each dwelling unit or rental unit.

2. An alternative method approved by the Utility Director.

1.8.3. Wastewater Systems

Connection with a TCEQ approved sanitary sewer system shall be required except where the City Council determines that such connection would require unreasonable expenditure of funds when compared with alternate methods of sewage disposal. Where alternate sewage disposal is permitted, the plans for such system must meet the requirements of the TCEQ and be approved by the Williamson or Travis County Health Department, whichever is appropriate, prior to approval of the final plat by the Planning and Zoning Commission.

The Developer shall install all wastewater mains and lines necessary to serve each lot in an entire subdivision, addition, or site development project. The Developer shall install necessary on-site and off-site sanitary sewer mains and shall extend service to all lots, terminating each service with a cap. For the orderly extension of wastewater lines as established in the City's Wastewater Master Plan, maintained by the Utility Director, the Developer shall install wastewater mains to the boundaries of their development for future connection by the development of the abutting land. Services from multi-family and non-residential lots shall connect at manholes.

Any wastewater collection system connecting to the City's wastewater collection system, whether public or private, shall be designed and constructed in accordance to the standards and specifications, herein.

The Developer's engineer shall include a statement with the wastewater system plans that the wastewater system meets the requirements of this Manual and complies with the rules and regulations established by the TCEQ in Chapter 217 (Design Criteria for Sewage Systems) and Chapter 213 (Edwards Aquifer Rules) of the Texas Administrative Code, as amended.

A. Determination of Wastewater Flow

1. Residential single-family units (one LUE equals one (1) single family unit) shall be assumed to produce an average wastewater flow of two hundred and eighty (280) gallons/day.
2. Industrial/commercial wastewater flows will be determined on a case-by-case basis in conjunction with information supplied by the design engineer.
3. Inflow and Infiltration (I/I)

   In sizing sewers, external contributions are accounted for by including one thousand (1,000) gallons per acre per day served for inflow and infiltration. For sewers in the Edwards Aquifer Recharge Zone, refer to the TCEQ requirements. Strict attention shall be given to minimizing I/I.
4. Peak Dry Weather Flow (PDWF)

   PDWF is the peak wastewater flow from the LUEs that are contributing to the sewer system, excluding inflow from surface water or infiltration of ground water. The PDWF is derived from the formula:

   $$Qpdwf = ([18+(0.018 \times F)^{0.5}]/4+(0.018 \times F)^{0.5}) \times F$$

   Where: F = 80 gal./person/day x No. of LUEs x 3.5/1440 = average dry-weather flow in gpm
5. Peak Wet Weather Flow (PWWF)

   The Peak Wet Weather Flow is obtained by adding I/I to the PDWF. In designing for an existing facility, flow measurement shall be used in lieu of calculations for the pre-existing developed area.
6. Minimum Flow.

   The minimum flow is derived from the formula:

   $$Qmin. = [0.2\ (0.0144 \times F)^{0.198}] \times F$$

B. Determination of Pipe Size

1. Minimum Size.

   All wastewater mains shall be installed in accordance with the Wastewater Master Plan maintained by the Utility Director. All wastewater mains shall be sized to provide necessary service to the tract to be developed. The minimum diameter of all gravity sewer mains shall be eight (8") inches. For service line sizes, refer to the City's Standard Details. The City may require oversizing of certain mains in accordance with City ordinances.
2. Design Requirements.

   For sewer mains, fifteen (15") inches in diameter or smaller, use the larger size as determined below:

   a. The main shall be designed such that the PDWF shall not exceed sixty-five (65) percent of the capacity of the pipe flowing full.

   b. The main shall be designed such that the PWWF shall not exceed eighty-five

(85) percent of the capacity of the pipe flowing full.

c. For sewer mains, eighteen (18”) inches in diameter or larger, the main shall be designed such that the PWWF shall not exceed eighty (80) percent of the capacity of the pipe flowing full. Full flow shall mean the capacity of a pipe that has a depth of flow equal to the pipe diameter, and the hydraulic grade is at the inside top of the pipe.

3. Design Velocities

The minimum design velocity calculated using the PDWF shall not be less than two (2) feet per second (fps). The maximum design velocity calculated using the PWWF should not exceed ten (10) fps. Velocities in excess of ten (10) fps may be considered under special conditions where no other options are available. In such cases, proper consideration shall be given to pipe material, abrasive characteristics of the wastewater flows, turbulence and displacement by erosion or shock.

4. Minimum Slope

The minimum slope for eight (8”) inch sewer mains within the service area of the City shall be four-tenths (0.4) percent slope. Flatter grades may be approved on a case-by-case basis by the City Engineer or Utility Director for mains in excess of eight (8”) inches in diameter.

C. Design Considerations

1. Materials and Standards

All materials and appurtenances shall conform to the City standards. Gravity wastewater mains shall be eight (8”) inch minimum and constructed of PVC (ASTM D 3034, SDR-26 or less), HDPE (AWWA C-906, ASTM F714, NSF 61 and PE 3408 by ASTM 3350) with a minimum 13.5 dimension ratio (DR) for rehabilitation of existing wastewater mains, Ductile iron (AWWA C-110), Fiberglass (ASTM D3262), or PVC (ASTM D3212 and A2026) “double wall”, or concrete (ASTM C76 with O-ring joint design). Gravity wastewater services shall be six (6) inches minimum and constructed of PVC (ASTM D 3034, SDR-26 or less) unless otherwise accepted by the City Engineer. All wastewater mains shall be profiled.

2. Protecting Public Water Supply

No physical connection shall be made between a drinking water supply and a sewer or any appurtenance thereof. An air gap of a minimum of two inlet pipe diameters between the potable water supply and the overflow level connected to the sewer shall be provided.

3. Location

The location of the wastewater main shall be in conformance with the City’s Standard Details. The DSO or the W/WWUD must approve alternative assignments. Outside the city limits, the design engineer shall coordinate utility assignments with the City W/WWUD or DSO, and other appropriate authority.

Standard assignment for wastewater mains shall be five (5) feet off the street centerline opposite from water, unless the City Engineer or Utility Director determines that an alternate location is acceptable.

4. Separation Distance

The separation between wastewater mains and other utilities shall be in accordance with the rules and regulations adopted by the TCEQ. Wastewater mains and services shall be installed with a minimum clearance of eighteen (18”) inches from other utility or drainage lines.

5. Steep grades

Where the pipe grade exceeds twelve (12) percent, concrete retards conforming to the City standards will be required at intervals of no more than twenty-five (25’) feet (preferably at joint locations).

6. Depth of Cover

The minimum depth of cover over the upper-most projection of the main shall comply with the City’s Standard Details; the maximum depth shall be as approved by the W/WWUD or the DSO for the specific material, application and conditions. The Engineer should strive to keep wastewater mains in streets at reasonable depths, eight (8’) feet from the top of the pavement to the flow line. Excessively deep wastewater mains, greater than twelve (12’) feet, shall be avoided, unless otherwise accepted by the City Engineer or Utility Director. When wastewater mains will be more than twelve (12’) feet deep from the flow line to the top of the finished surface and services to the main are required, an alternate method of intercepting services or alternate service design shall be provided. For example, a parallel line that is laid at a shallower depth might be designed to pick up services and the line tied to the deep main at one (1) or more practical locations. Encasement pipe shall be provided under permanent structures. Concrete encasement shall be avoided.

7. Easements

Wastewater mains along the rear of residential lots, continually through back yards, shall be prohibited. Wastewater mains between residential lots, crossing blocks, shall be avoided where possible. When unavoidable, such mains shall be laid along a straight alignment, absent of curves, jogs, and manholes when traversing between lots, with manholes provided at every intersecting street. Excessive depths of mains in easements shall be avoided. Easements shall be a minimum of fifteen (15’) feet in width with an additional two (2’) feet of easement width for every one (1’) foot of depth over eight (8’) feet. Utility or easement lots may be appropriate in some cases.

8. Turbulence

Wastewater lines and manholes shall be designed to minimize turbulence to prevent release of sulfide gases and subsequent corrosion.

D. Manholes

1. Manholes shall be located and spaced so as to facilitate inspection and maintenance of the wastewater main. Manholes shall be placed at the following locations:

   a. Intersections of mains.

   b. Horizontal alignment changes.

   c. Vertical grade changes.

   d. Change of pipe size.

   e. Change of pipe material.

   f. The point of discharge of a force main into a gravity wastewater main.

   g. Intersection of service lines to main lines twenty-four (24) inches and larger.

   h. A manhole is required at the point of connection of a building service line to the public wastewater service stub for multi-family projects exceeding fifteen (15) dwelling units and for commercial developments (containing more than four thousand (4,000) square feet) requiring a water meter greater than two (2) inches.

   i. Manholes shall be reinforced concrete and conform to the City's Standard Details.

   j. Connections to existing manholes shall be made by coring and conform to the City's Standard Details.

2. Manhole spacing for lines smaller than twenty-four (24) inches shall not exceed four hundred (400) feet; for larger mains, spacing may be increased, subject to approval by the W/WWUD or the DSO.

3. All manholes not located in paved areas shall have bolted watertight covers.

4. Manholes shall be constructed of or lined with a corrosion resistant material. Where new construction ties into an existing manhole, the existing manholes must be lined, coated, or replaced with a corrosion resistant material. If the existing manhole is in poor condition, the manhole must be repaired or replaced prior to lining or coating.

5. All lines into manholes, including drop connections, shall match crown-to-crown where feasible. Any deviation must be approved in advance by the DSO or Utility Director.

6. Drop manholes will have a maximum of eight (8') foot of drop and require City Engineer or Utility Director Approval where the main size exceeds fifteen (15") inches.

7. Manholes shall have the following minimum sizing:

   a. Forty-eight (48) inches for mains eighteen (18") inches in diameter or smaller.

   b. Sixty (60) inches for mains larger than eighteen (18") inches and smaller than thirty (30) inches in diameter.

c. Seventy-two (72) inches for thirty (30”) inches in diameter to smaller than forty-eight (48) inches in diameter.

d. Eighty-four (84) inches diameter for mains forty-eight (48”) inches and larger.

E. Ventilation

Ventilation shall be provided as required by TCEQ rules and regulations.

F. Inverted Siphons

Siphons shall have a minimum of two barrels. The minimum pipe size shall be six (6) inches with a minimum flow velocity of three (3) fps at peak dry weather flow. The minimum dry weather flow shall be used to size the smallest barrel. Three-barrel siphons shall be designed to carry the capacity of the incoming gravity wastewater mains(s) with one barrel out of service.

An additional corrosion resistant pipe shall be designed to allow for the free flow of air between the inlet and outlet siphon boxes. The diameter of this air jumper shall not be smaller than one-half the diameter of the upstream sewer. Air jumper pipe design shall provide for removal of condensate water that will collect in the pipe.

Siphon inlet and outlet structures shall be manufactured with approved corrosion resistant material and shall provide for siphon cleaning and maintenance requirements.

G. Service Lines

Wastewater service lines, between the main and property line, shall have an inside diameter not less than six (6”) inches. The minimum grade allowed for service lines is one (1) percent. Service connections made to mains larger than fifteen (15”) inches in diameter shall be considered on a case-by-case basis. Services into the top of mains, stack-type, shall be prohibited. Services shall be laid on straight grade from main to point of termination, without horizontal or vertical bends, unless otherwise approved by the City Engineer or Utility Director.

Usually wastewater services are placed along the common property line between two lots where there is no conflict with other utilities' services. All other Utility service is usually located at the other lot corner. Wastewater service should be placed two (2’) feet on the right of the common lot line. Dry utilities are placed two (2’) feet left of the common lot line. Services to lots without a water/wastewater easement will terminate at the property line with a clean-out; service to lots having a five foot by five foot (5’ x 5’) water/wastewater easement will terminate within the easement. For details, see the City’s Standard Details.

Single-family and duplex service connections shall be made with sanitary tees at a ninety (90) degree intersection with mains. Commercial, multi-family, and industrial services shall intersect the City system at a manhole.

H. Lift Stations Design Criteria (Excluding Low Pressure Systems)

Lift stations are discouraged and should be avoided. Lift stations will be allowed only where conventional gravity service is not feasible (Lift station installation

cost plus thirty (30) years Operation & Maintenance (O&M) expense is less than installation cost for gravity system). These sub-section details the specific design criteria for wastewater lift stations proposed for immediate or future City operation and maintenance within the City or its ETJ. The Utility Director or his designee may impose additional requirements for individual lift stations as conditions warrant.

In addition to these criteria, all lift stations must meet the TCEQ Chapter 217 rules and the provisions of this Manual.

1. Flow Development

Calculation of wastewater flow shall be done in accordance with Section 1.8.3.A. The following calculations shall be included:

a. Maximum Wet Weather Flow (Design Flow)

This flow is used to determine the lift station design capacity. All lift stations shall be designed to handle the maximum wet weather flow for its service area.

Equation: (Population of service area x 80 gallons per capita per day (gpcd) x maximum flow peaking factor) + (1000 gallons per acre served)

b. Maximum Dry Weather Flow

This flow is used to determine pipe size in the collection system.

Equation: (Population of service area) x (80 gpcd) x (maximum flow peaking factor)

c. Average Dry Weather Flow

This is the flow developed without the maximum flow peaking factor. This flow is used to determine the average detention time in the wet well.

Equation: (Population of service area) x (80 gpcd)

d. Minimum Dry Weather Flow

This is used to determine the maximum detention time in the wet well.

Equation: (Population of service area) x (80 gpcd) x (minimum flow peaking factor)

e. A minimum of two (2) pumps shall be required for all lift station. The capacity of the pumps shall be such that the maximum wet weather flow can be handled with the largest pump out of service.

2. Wet Well Design

a. The bottom of the wet well shall have a minimum slope to the intake of two (2) vertical to one (1) horizontal. There shall be no projections in the wet well, which would allow deposition of solids.

b. The wet well volume shall be sized to provide adequate storage volume at

peak design flows and a pump cycle time of sufficient duration to prevent pump short cycling and consequential motor damage. Pump cycle time, defined as the sum of "pump off" time plus "pump on" time, shall be as follows:

Motor Horse Power	Minimum Cycle Time In Minutes (θ)
2 to 50	10
51 to 75	15
76 to 250	30
251 to 1500	45

Volume between "pump on" and "pump off" elevation (of the pump cycle) shall be determined by the following criteria:

$$V = \theta q/4$$

where q = pump capacity in gpm and θ is the minimum cycle time in minutes.

c. All "pump on" levels shall have a minimum separation of one (1') foot between levels. All "pump off" levels shall be at least six (6") inches above the top of the pump casing. For more than two (2) pumps, the "pump off" levels shall be staged with a minimum separation of one (1') foot between levels.

d. An example of a two (2) pump staging sequence follows:

High-level alarm

Lag pump on

Lead pump on

Lag pump off

Lead pump off

Low-level alarm

The high level alarm shall be at least one foot above the last (highest) "pump on" level in the wet well and also at least one (1') foot below the flow line of the lowest influent line into the wet well.

For lift stations with three (3) pumps or more, the following method for calculating the wet well volume may be used:

$$V = 2 \times q_1/4 \quad \text{and} \quad K = (q_1 - q_2) + q_1$$

$$V_2 = V' \times N \times V_1$$

Where: V_1 = working volume for the first pump in gallons

θ = minimum cycle time in minutes

q_1 = capacity of the first pump in gpm

q_2 = capacity of the second pump in gpm

K = the ratio of the discharge increment to the discharge of the first pump, without dimensions

V_2 = working volume for the second pump in gallons

V' = the ratio of additional draw down volume to the volume for one pump, without dimensions

N = number of pumps

1) Calculate V_1 and K.

2) Locate K on Table 1 and read the corresponding value for V'.

3) Calculate V_2.

f. An example of a three (3) pump starting sequence is as follows:

High-level alarm

Third pump on

Second pump on

First pump on

Third pump off

Second pump off

First pump off

Low Level alarm

For the location of the high level alarm, refer to the example of a two pump starting sequence.

g. Adequate space should be provided between the bottom of the wet well at the intake of the pumps.

TABLE 1: V' Values Corresponding To Various Values

K	V'	K	V'	K	V'
0.00	0.00	2.10	1.36	3.49	2.63
0.33	0.00	2.13	1.39	3.53	2.67
0.44	0.01	2.17	1.42	3.57	1.70

0.53	0.04	2.20	1.45	3.61	2.74
0.62	0.08	2.23	1.49	3.65	2.77
0.70	0.12	2.27	1.52	3.69	2.81
0.77	0.16	2.30	1.55	3.73	2.85
0.84	0.21	2.34	1.58	3.77	2.88
0.90	0.25	2.37	1.62	3.81	2.92
0.96	0.29	2.41	1.65	3.85	2.96
1.02	0.34	2.45	1.68	3.89	3.00
1.07	0.38	2.48	1.71	3.93	3.03
1.12	0.42	2.52	1.75	3.97	3.07
1.17	0.46	2.55	1.78	4.01	3.11
1.22	0.51	2.59	1.81	4.05	3.15
1.26	0.55	2.62	1.84	4.09	3.18
1.30	0.59	2.66	1.88	4.13	3.22
1.34	0.63	2.70	1.91	4.17	3.26
1.38	0.66	2.73	1.94	4.21	3.30
1.42	0.70	2.77	1.97	4.25	3.34
1.46	0.74	2.81	2.01	4.29	3.38
1.50	0.78	2.84	2.04	4.33	3.42
1.54	0.81	2.88	2.07	4.38	3.45
1.57	0.85	2.92	2.11	4.42	3.49
1.61	0.89	2.95	2.14	4.46	3.53
1.65	0.92	2.99	2.18	4.50	3.57
1.68	0.96	3.03	2.21	4.54	3.61
1.72	0.99	3.07	2.24	4.58	3.65
1.75	1.03	3.10	2.28	4.63	3.69
1.79	1.06	3.14	2.31	4.67	3.73
1.82	1.09	3.18	2.35	4.71	3.77
1.86	1.13	3.22	2.38	4.75	3.81
1.89	1.16	3.26	2.42	4.79	3.85
1.92	1.19	3.29	2.45	4.84	3.89

1.96	1.23	3.33	2.49	4.88	3.93
1.99	1.26	3.37	2.52	4.92	3.97
2.03	1.29	3.41	2.56	4.96	4.01
2.06	1.33	3.45	2.59	5.01	4.05

K = Pump discharge (Dimensionless) **V'** = Volume (Dimensionless)

Source: ALBERT PINCINE

3. Wet Well Detention Time

a. Calculate the detention time (T_d) in the wet well for the maximum wet weather flow, maximum dry weather flow and average dry weather flow using the following equation:

$$T_d = t_f + t_e$$

Where:

t_f = (v) ÷ (i) = time to fill the wet well in minutes

t_e = (v) ÷ (q - i) = time to empty the wet well in minutes

V = Volume of wet well between "pump on" and "pump off" elevations in gallons

q = Pump capacity in gpm

i = flow into the station corresponding to the maximum wet weather flow maximum dry weather flow or average dry weather flow in gpm

b. Maximum detention time shall be calculated with i = minimum dry weather flow.

c. Odor control shall be provided for the wet well, if the total detention time in the wet well and force main system exceeds 180 minutes.

4. Static Head

The static head shall be calculated for "pump on" and "pump off" elevations in the wet well.

5. Net Positive Suction Head

The Net Positive Suction Head (NPSH) required by the pump selected shall be compared with the NPSH available in the system at the eye of the impeller. The engineer shall consult the pump manufacturer for the NPSH required values for that pump and compare them with calculated values for the NPSH available. The NPSH available should be greater than the NPSH required for a

flooded suction pump. The following equation may be used for calculating the NPSH available:

$$NPSH_A = P_B + H_S - P_V - H_{fs}$$

Where:

P_B = barometric pressure in feet absolute,

H_S = minimum static suction head in feet,

P_V = vapor pressure of liquid in feet absolute,

H_{fS} = friction loss in suction in feet.

For lift stations in Round Rock's service area a barometric pressure of thirty-three and four tenths (33.4') feet may be used and a vapor pressure of one and four-tenths (1.4') feet may be used. These value are based on the following assumptions: an altitude of five hundred (500) feet above sea level, a water temperature of 85ºF and a specific gravity of water of 0.996 at 85ºF.

6. Suction Piping Design

a. All suction piping shall be flanged ductile iron and have a minimum diameter of four (4") inches. Each pump shall have a separate suction pipe.

b. Suction piping shall have a velocity of three (3) to five (5) fps.

c. All suction pipes inside the wet well shall be equipped with a flare type, down-turned intake. The distance between the bottom of the flare and the floor of the wet well shall be between D/3 and D/2 where D is the diameter of the flare inlet.

7. Force Main Design

a. All force mains shall be Ductile Iron, Class 150 with non-corrosive PVC C-900 lining, an approved HDPE, or PVC C-900, Class 150 with a minimum diameter of four (4") inches. Force main pipe within the station shall be flanged. Flexible fittings shall be provided at the exit wall.

b. Force mains shall be sized so that the flow velocity is between three (3.0) and six (6.0) feet per second at ultimate development. During initial development phases, flow velocities may be as low as two and one half (2.5) feet per second.

c. The maximum time required to flush the force main shall be calculated on the basis of average dry weather flow. Flush time shall be calculated for average dry weather flow using the following equations:

*See Section 1.8.3.H.3.a, "Wet Well Detention Time", for an explanation of V and q.

d. Odor and corrosion control shall be provided for the force main if the force main detention time exceeds thirty (30) minutes.

e. The design engineer shall evaluate location and size of all air release valves

for odor or nuisance potential to adjacent property. The use of air release valves shall be restricted to installations where there are no possible alternatives.

f. Lift station/force main systems shall be evaluated for their sulfide generation potential and their ability to achieve scouring velocities during average dry weather flow periods. If the evaluation indicates that sulfide concentration of greater than two (2) ppm and solids deposition are likely, the design shall:

1) define a workable sulfide control technique that will minimize sulfide formation in the force main;

2) include "pig" launching stations and recovery points to allow cleaning of the force main; and

3) protect the gravity main and manholes downstream of the force main from corrosion. The length of pipe to be protected shall be determined on a case-by-case basis.

g. The force main shall discharge into it's own distinct manhole. (i.e. multiple force mains shall not discharge into a single manhole.)

h. Thrust restraint when required shall be shown on the plan view.

8. Head Loss Curves

a. Data points for the system capacity curve shall be provided in tabular form and graphed with pump head capacity curve on the same graph. Two (2) system capacity curves shall be plotted using the Hazen Williams coefficient values of C = 100 and C= 120.

b. Pump output in gpm at maximum and minimum head shall be clearly shown on the system curve for each pump and combination of pumps.

c. For stations with two (2) or more pumps operating in parallel, multiple and single operation points shall be plotted on the system curve.

d. Pumps with the highest efficiencies at all operating points shall be used.

e. If pumps are equipped with smaller impellers during start up to handle lower than design flows, impellers sized to handle the design flow shall also be provided.

9. Buoyancy Calculations

The lift station design shall include a complete analysis of buoyant forces on the entire lift station structure.

10. Water Hammer

a. Calculations for water hammer showing maximum pressures, which would occur upon total power failure while pumping, shall be provided using the following equations:

$$p = (a)(V) / (2.31)(g) + \text{operating pressure of pipe (psi)}$$

$$a = 12 \div \{ (w/g) [(1/k) + (d/Et)] \}^{0.5}$$

Where:

p = water hammer pressure (psi)

a = pressure wave velocity (ft/s)

w = specific weight of water (62.4 lb/ft^3)

g = acceleration of gravity (32.2 ft/s^2)

k = bulk modulus of water (300,000 psi)

d = inside diameter of pipe (in)

E = Young's modulus of pipe (psi)

t = pipe wall thickness (in)

v = flow velocity in pipe (ft/s)

Surge control measures shall be provided when pressures, including those due to water hammer, exceed the pressure rating of the pipe.

11. Suction Specific Speed

Suction specific speed of the pumps shall be calculated using the following formula:

$$SSS = \Sigma(Q)^5 / (H)^{75}$$

Where: SSS = Suction specific speed (rpm)

Q = flow at best efficiency point, gallons per minute (gpm)

H = net positive suction head required at maximum impeller speed, in feet

Σ = speed of pump and motor, in revolutions per minute (rpm)

Suction specific speed should be below 9,000 rpm to ensure that the pump would not cavitate because of internal recirculation.

12. Stiffness Ratio

In order to ensure that the pump shaft does not bend an excessive amount, the engineer shall calculate the stiffness ratio of the shaft using the following equation:

$$\text{Stiffness Ratio} = L^3/D^4$$

Where:

L = distance from impeller centerline to the centerline of the inboard bearing, in inches

D = diameter of shaft (inches)

The stiffness ratio shall not exceed sixty (60).

13. Energy Calculations

For lift stations with flows exceeding seventy five (75) gpm but less than one thousand (1,000) gpm, and if the engineer is considering a submersible type lift station as an option then the engineer shall submit cost comparisons for submersible stations versus wet well/dry well stations. These cost comparisons should include the initial station costs, installation costs and power costs for the life of the station.

Energy costs for each type station shall be calculated using the following equations:

a. Calculate the water horsepower required.

$$WP = (Q)(h)(8.34 \text{ lbs./gal}) / 33{,}000 \text{ ft-lb min/hp}$$

Where:

WP = water horsepower (hp)

Q = flow, gallons per minute (gpm)

h = head, feet (ft)

b. Calculate the brake horsepower required.

$$BHP = WP / \text{pump efficiency}^*$$

Where:

BHP = brake horsepower (hp)

WP = water horsepower (hp)

* Use the most efficient pumps for the application.

c. Calculate the electrical horsepower required

$$EHP = BHP / \text{motor efficiency}$$

Where:

EHP = electrical horsepower (hp)

BHP = brake horsepower (hp)

*Use the most efficient motors for the application.

d. Calculate the power required in kilowatts.

$$EKW = (EHP)(0.746 \text{ Kw/hp})$$

e. Calculate daily power consumption in kilowatt-hours.

$$E = [(EKW_1)(t_1) + (EKW_2)(t_2) + (E\,KW_3)(t_3)...]$$

Where:

E = total power consumption, kilowatt hours (kWh) per day

EKW_n = power required, kilowatts for pumps 1,2,...,n

t_n = estimated pump run time in hours per day for pumps 1, 2, …, n

f. Calculate the estimated cost for power consumption over the life of the station.

C = (E)($0.12/kWh)(T)

Where:

C = cost of power over the life of the station (dollars)

E = power consumption (kilowatt-hour per day - kWh/day)

T = time the station is expected to be in service (days)

g. Stress and thrust calculations for internal station piping and bends shall be provided for stations with flows over one thousand (1,000) gpm.

14. Sump Design

The following items apply for lift station dry well sump pumps:

a. Dual submersible sump pumps, each with a minimum capacity of one thousand (1,000) gallons per hour (gph), shall be provided.

b. The design head of the sump pumps should be the static head from the sump to one (1') foot above the one hundred (100) year flood level plus allowances for pipe friction both inside and outside the pump chamber.

c. Sump piping shall be galvanized steel with a minimum diameter of two (2") inches.

d. Sump discharge from the dry well shall be installed through the wall of the wet well at a point not less than twelve (12") inches above the top of the influent pipe and grouted in place with a water tight seal.

e. The dry well floor shall slope toward the sump pit.

15. Specific Station Requirements

a. All stations will be required to have an equipment-lifting device.

b. Engineering calculations are required showing that temperatures inside the dry well do not exceed 85°F, while the pumps are operating.

c. Stations with motors greater than one hundred (100) hp shall use a horizontal pump/motor configuration.

d. Stations with motors that are seventy-five (75) hp and larger shall have reduced voltage starters of the autotransformer or solid-state soft start type. Part winding starters and motors are not acceptable. Motors larger than seventy-five (75) hp shall be designed with a maximum temperature rise not to exceed 80°C over a 40°C ambient temperature. Motors larger than three hundred (300) hp may require a higher temperature rise and may be specifically approved with such.

e. Motors seventy-five (75) hp and smaller shall be provided with high efficiency

frames. Maximum temperature rise shall not exceed 90°C over a 40°C ambient temperature.

f. Stations deeper than thirty (30') feet, measured from the finished floor to the top of the entrance tube, shall require an electrically powered personnel lift.

g. Entrance hatches larger than forty (40") inches in diameter shall be spring-loaded.

h. Valves higher than six (6') feet above the floor shall have chain operators.

i. Any potable water supply below the overflow elevation of the wet well shall be protected by an air gap.

j. All lift stations must have a back-up power source. Looped service from two (2) different substations is adequate backup power. If a back-up electric system is not feasible, a diesel generator shall be located on the lift station site instead. Generator shall be equipped with noise and air pollution control devices. k. Flow monitoring will be provided for all lift stations.

16. Wastewater Lift Station Specifications

In addition to the design criteria presented in this document, the W/WWUD has the "Wastewater Lift Station General Specifications and Drawings". These documents delineate minimum City requirements as they relate to the construction and installation of wastewater lift stations. Copies of these documents are available and can be obtained from the W/WWUD.

17. Exceptions

Exceptions to these design criteria must be requested in writing. Written approval from the Director of the W/WWUD or designee must be obtained before any exceptions will be allowed.

I. Alternate Wastewater Systems

1. General

Low-pressure wastewater systems are discouraged and will be allowed only where conventional gravity service is not possible. For the purpose of these criteria, low-pressure sewer service is defined as private grinder pump facilities or private septic tank effluent pump facilities that do not convert to gravity flow at or prior to the property line. There shall be no more than one grinder pump facility per single family or duplex residential lot. Each grinder pump shall discharge to a gravity flow system. Grinder pump facilities for commercial establishments, Public Utility Districts (PUD) or condominiums will be considered on a case-by-case basis.

The distance for each grinder pump from the property line to the gravity main shall not exceed two hundred (200') feet.

Flows may be calculated using the Lift Stations Design Criteria provided in Section 1.8.3.H. above disregarding the Infiltration/Inflow flow component.

If the above criteria are applicable and a low-pressure wastewater service is

necessary, The W/WWUD will be responsible for maintaining the portion within the right-of-way only.

Design and installation of the property owner's pumping system, as well as all associated plumbing shall be reviewed, approved and inspected by the City. The system shall be designed as a complete system including all connections, pumps, etc. for lots being served by the system. If the above criteria are not applicable, refer to Lift Stations Design Criteria, Section 1.8.3.H.

2. Connection to Gravity Main

   Each grinder pump facility shall be individually tied into a manhole on an existing gravity main. If a manhole does not exist, one shall be constructed. Construction costs and all other associated costs shall be the responsibility of the property owner.

   The connection to the gravity main shall be designed to minimize turbulence and the release of hydrogen sulfide. The discharge point shall be at or below the spring line of the gravity main.

3. Clean-out and Valve Assemblies

   A clean-out and corrosion resistant eccentric plug valve shall be placed just inside of the right-of-way where City maintenance begins and private maintenance ends. This clean-out will allow the property owner's system to be isolated and the City's portion of the system to be pressurized, flushed or rodded.

   Clean-outs and corrosion resistant eccentric plug valves shall also be installed at bends of 45° degrees and greater. Refer to applicable City Standard Detail(s).

4. Separation Requirements

   The separation between low-pressure sewer lines and waterlines shall comply with the TCEQ rules and regulations, City's DACS - Standard Specifications Manual and all other applicable rules and regulations.

5. Grinder Pump System General Specifications and Drawings

   In addition to the design criteria presented in this Manual, the W/WWUD maintains the "Grinder Pump System General Specifications and Drawings". These documents delineate minimum City requirements as they relate to the construction and installation of grinder pump systems. Copies of these documents are available and can be obtained from the W/WWUD.

1.8.4. Reuse Water Systems

Priority is given to reuse water facilities because of their critical nature. Pressure, supply, sanitation, and ease of maintenance of reuse water facilities are paramount to all other public works concerns.

Any reuse water distribution system connecting to the City's reuse water distribution system, whether public or private, shall be designed and constructed in accordance to the standards and specifications, herein.

If determined by the Utility Director that the development is suitable for reuse water then, the developer shall provide all reuse water lines necessary to properly serve the project, and insure that existing and/or new reuse water facilities can supply the required demand. The developer shall install all necessary on-site and off-site mains and shall extend service to all lots terminating with a meter stop and meter box. For the orderly extension of reuse water lines as established in the Reuse Water Master Plan, maintained by the City Utility Director, the developer shall install reuse water mains to the boundaries of his development of the abutting land. The developer shall submit a letter certifying and sealed by a Professional Engineer licensed by the State of Texas that the system has been designed in accordance with the requirements of this section and conform to the rules, regulations, and requirements established by the TCEQ Design Criteria in the Texas Administrative Code, as amended.

A. Size/Capacity Determination

1. General

a. Hazen Williams Friction Coefficient C = 120, higher C coefficient may be used for new mains only upon approval by the City with sufficient documentation to show effects of long-term use.

b. Average day demand = two hundred and three (203) gal/person/day

c. Peak day demand = four hundred and six (406) gal/person/day

d. Peak hour demand = eight hundred and ninety-three (893) gal/person/day

e. Maximum static pressure – one-hundred (100) psi unless otherwise approved by the Utility Director.

f. If the maximum static pressure exceeds eighty (80) psi, a PRV will be required on the property owner's side of the reuse water meter and should be shown on the plan view.

g. Minimum operating pressure is forty (40) psi at the highest elevation meter location using average day demands.

2. Peak Hour Demand Requirements

a. The maximum allowable velocity shall not exceed six and one half (6.5') feet per second (fps).

b. The minimum pressure at any point in the affected pressure zone must not be less than thirty-five (35) psi.

3. Sizing of Water Mains

All reuse water mains shall be installed in accordance with the Reuse Water Master Plan maintained by the Utility Director. Computer modeling is preferred for sizing reuse water mains. However, for reuse water mains less than sixteen (16) inches in diameter other engineering calculation methods may

be accepted. The largest size, as determined by comparing the service area's peak hour demand and peak day plus fire flow demand, shall be used. All reuse water mains shall be sized to provide necessary service to the tract being developed. The City may require oversizing of certain mains in accordance with City ordinances.

B. Mains

1. Minimum main size shall be eight (8”) inches unless the Utility Director approves a smaller size because of unique circumstances. Provisions for a flush valve at the end of dead end mains may be required. The minimum size for any street type, however, will be governed by various factors which include high density land usage, and the designer's consideration of general system gridding, future mains, neighboring developments and area configuration. Looped systems are not required at this time. Main sizes will be as shown in the Reuse Water System Master Plan or determined on a case-by-case basis and approved by the Utility Director.
2. Ten (10”) inch, fourteen (14”) inch, and other non-standard pipe sizes shall not be allowed in typical construction.
3. Reuse water mains in excess of eight (8”) inch diameter shall be profiled in the construction drawings. All reuse water mains shall be profiled in areas of possible conflicts.
4. Reuse water mains shall be located where maintenance can be accomplished with the least interference with traffic, structures, and utilities.
5. The separation between reuse water, water and wastewater mains must comply with TCEQ rules or have a variance approved by the TCEQ before submittal to the City. Reuse water mains shall be installed with a minimum of eighteen (18) inches clearance from other utility and drainage lines.
6. The standard assignment for reuse water mains shall be on a case-by-case basis being a minimum of four (4’) feet horizontally and two (2’) feet vertically from the potable water line. Reuse water mains shall be on public property or within a dictated easement generally toward the high side of the street according to natural topography unless otherwise accepted by the Utility Director. The latter requirement may be relaxed if it is demonstrated there is one or more compelling reasons to assign a main on the low side of a street (i.e. numerous crossings are avoidable, maintenance is facilitated, etc.)

   When reuse water mains are located outside of the right-of-way, they shall be within a recorded utility easement. Main assignments in City streets must be approved by the DSO and the Utility Director. Mains in county roads must also be approved by the County Engineer.
7. Piping materials and appurtenances shall conform to the City’s DACS - Standard Specifications Manual.
8. Minimum depth of cover over the uppermost projection of the pipe and all appurtenances shall comply with City’s Standard Details; maximum depth will

be as approved by the DSO and the Utility Director for the specific materials, application and conditions. Reuse water mains shall be kept at reasonable depths (three and one half foot to four foot (3 ½' to 4') cover in unpaved areas and a minimum of thirty (30) inch cover below sub-grade in paved areas) and reuse water main crossings under utilities shall be avoided. There will be some cases where mains at greater depths may be warranted, (i.e. larger mains, mains where future locations of improvements are unknown, etc.). Reuse water mains under wastewater mains are discouraged. Where unavoidable, reuse water main crossings under other utilities or drainage pipes may be accepted by the Utility Director on a case-by-case basis. Such acceptance shall be based on detailed plans and exhibits that adequately explain and demonstrate the crossing. Encasement pipe shall be provided under permanent structures. Concrete encasement shall be avoided; concrete trench caps above bedding are generally acceptable.

9. For mains sixteen (16") inches and larger, drain valves may be required at low points.
10. All reuse water service lines shall have a gate valve on the line at the connection to the main line and a backflow preventer inside the property line, but accessible for inspection by City personnel. All un-metered reuse water service shall have a Utility Director approved flow detection device.
11. The design engineer is responsible for determining when air/vacuum release valves are required. On reuse water mains sixteen inches (16") in diameter and larger, automatic air release valves will be placed at all high points and at the down-slope side of all valve locations. Automatic air/vacuum and vacuum release valves shall be approved on a case-by-case basis.
12. All pipe and accessories shall be of new materials only. Reuse water mains shall be Ductile Iron (AWWA C-110, C-104 ANSI/AWWA C-153/A21.53-84, min. pressure Class 150) or PVC (AWWA C-900, ASTM F477 and D3139, min. pressure Class 150). Service piping shall be polyethylene as accepted by the Utility Director. All reuse water piping shall be purple or purple wrapped. Minimum size of service lines shall be as follows:

Parcel Acreage	Minimum Line Size
1/3 - 1	1"
1-2	1.5"
3-6	2"
7-11	4"
12-75	6"
More Than 75	8"

13. Service lines under pavement shall be placed in an encasement pipe.

14. Reuse water mains between residential lots, crossing blocks, shall be avoided. Reuse water mains along the rear of residential lots, through back yards, shall be prohibited. Utility or easement lots may be appropriate in some cases.

15. Laying of reuse water mains within state right-of-way shall be prohibited unless such is warranted, as determined by the Utility Director. Reuse water lines in easements abutting the state right-of-way are allowed provided easements are unobstructed and accessible.

16. Reuse water mains in easements will be allowed, if it can be demonstrated that the easement will be unobstructed and accessible, and that the reuse water main will be a minimum of fifteen (15') feet from any structure. Minimum easement width shall be fifteen (15') feet and an additional two (2') feet of easement width provided for every one (1') foot of depth of cover greater than seven (7') feet. Minimum easement between residential lots shall be thirty (30') feet.

17. **Meter boxes and vaults shall be reviewed and approved by the Utility Director.**

C. Valves

1. All valves sixteen (16") inches and smaller, shall be resilient seated gate valves. In lines larger than sixteen (16") inches and smaller than thirty six (36") inches, double disc gate valves are specifically required. In lines thirty six (36") inches and larger, butterfly valves may be used except in areas described below where double disc gate valves are specifically required.

2. Valves shall be located at the intersection of two (2) or more mains and shall be spaced so that no more than 1,000 feet of reuse water line in commercial, industrial, or multi-family residential is without water during a shutout. Valves shall be located at the intersection of two (2) or more mains and shall be spaced so that no more than 2,000 feet of reuse water line in off-site transmission mains, and in residential subdivisions is without water during a shutout.

3. At dead ends, gate valves shall be located one (1) pipe length, with an eighteen (18) to twenty (20) foot minimum, from the end point of the main. In lines larger than sixteen (16) inches, these shall be double disc gate valves. The Engineer shall provide and show drawings for complete restraint for all such valves, pipe extensions and end caps.

4. Branch piping, both new and future branches shall be separated from the main with gate valves. In branches larger than sixteen (16") inches these shall be double disc valves.

5. For mains twelve (12") inches and smaller, valves at street intersections shall

be located at opposite point of curvature (p.c.) of the curb line.

6. All valves from six (6”) inches to twenty four (24”) inches shall be gate valves. Gate valves shall be located on each side of a tee or cross (i.e. each tee will require three (3) gate valves and each cross will require four (4) gate valves to be installed). Variations from these requirements require approval by the Director of Utilities.
7. Double disc gate valves may be required at locations where, in the judgment of the City Engineer or Utility Director, complete shut out is critical.
8. The operating nut of any valve shall be between eighteen (18”) inches and thirty (30”) inches below finished grade. Extensions of valve nuts shall be provided as necessary to meet the depth requirement. Extensions shall not be fixed to operating nut.
9. Valves with valve extensions and those at pressure zone boundaries shall be equipped with a locking type debris cap.
10. All gate valves and butterfly valves shall be installed in accordance with the City’s Standard Details.

D. Services

1. Reuse water services shall be constructed in accordance with the City’s Standard Details. More than two meters on a single service line will be considered on a case-by-case basis.
2. Individual meter services will not be taken from transmission lines. Transmission lines are generally considered to be twenty-four (24”) inches in diameter or larger. Exceptions must be approved by DSO and the W/WWUD at the time of plan submittal. The Professional Engineer shall submit a letter with this request.

F. Reuse Water Meters for Multi-Family and Commercial Customers

A reuse master meter may be required for building permits issued by the City for multi-family, manufactured home rental community, commercial property, or any other multiple-use facility, if recommended by the City. The measurement of the quantity of water, if any, consumed by the occupants of each individual unit shall be provided by the following:

1. Sub-meters, owned by the property owner or manager, for each dwelling unit or rental unit.
2. An alternative method approved by the Utility Director.